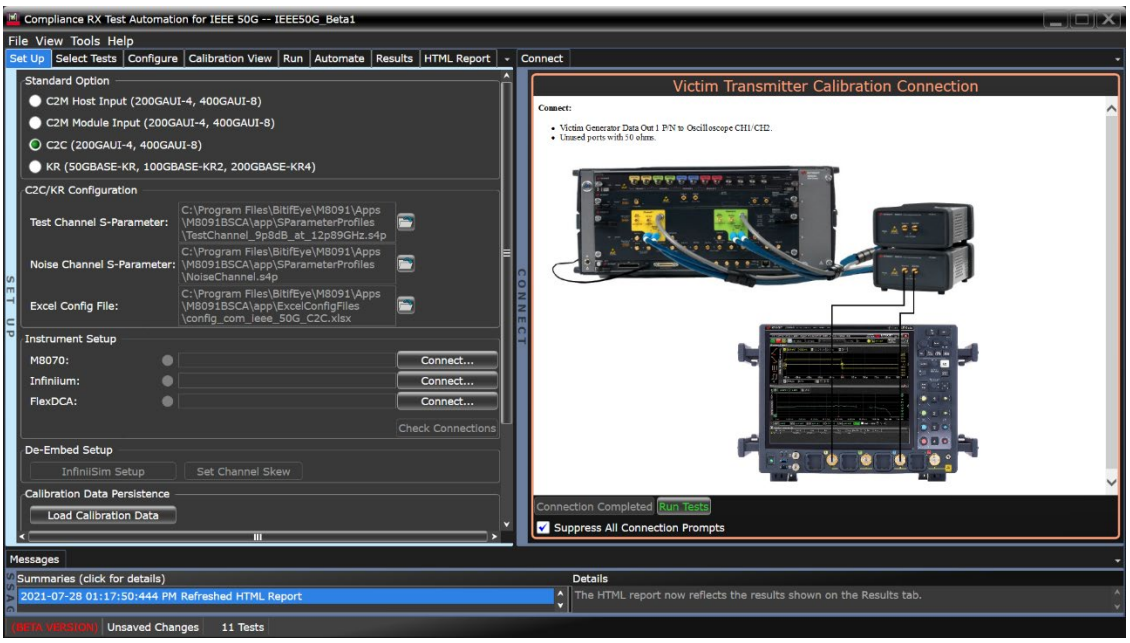
M8091BSCA

Receiver Conformance Test Application for IEEE802.3bs/cd

Introduction

Keysight M8091BSCA is a new conformance receiver test solution for 50G serial that provides wider standard coverage such as Chip-to-Chip (C2C) and Backplane (KR) interfaces and Copper Cable (CR) interfaces.



KEYSIGHT

Keys Features

- Supported standards include the following:
  - IEEE 802.3bs 200GAUI-4 & 400GAUI-8 Chip-to-Module (C2M) Annex 120E
    - 120E.3.3.2 Host Stressed Input Test
    - 120E.3.4.1 Module Stressed Input Test
  - IEEE 802.3bs 200GAUI-4 & 400GAUI-8 Chip-to-Chip (C2C) Annex 120D
    - 120D.3.2.1 Receiver Interference Tolerance
    - 120D.3.2.2 Receiver Jitter Tolerance
  - IEEE 802.3cd 50GBASE-KR, 100GBASE-KR2, 200GBASE-KR4 Backplane (KR) Clause 137.9.3[1]
    - 120D.3.2.1 Receiver Interference Tolerance
    - 120D.3.2.2 Receiver Jitter Tolerance
  - IEEE 802.3cd 50GBASE-CR, 100GBASE-CR2, 200GBASE-CR4 Copper Cable (CR) Clause 136.9.4
    - 136.9.4.2 Receiver Interference Tolerance
    - 136.9.4.3 Receiver Jitter Tolerance
    - 136.9.4.1 Receiver Input Amplitude Tolerance

- Guided setup, automated stress signal calibration and conformance measurement
- HTML test report
- Choose between Node-locked, Transportable, Network, USB-dongle license types of the Perpetual license term

Description

The M8091BSCA electrical receiver conformance test application is designed to assist and simplify the input test for 200GAUI-4 and 400GAUI-8 PAM4 capable host, module, backplane, and copper cable interfaces. It reduces user interaction to a minimum and performs all required calibration routines and conformance testing automatically by remote controlling all required instruments.

1 See limitation on page 6

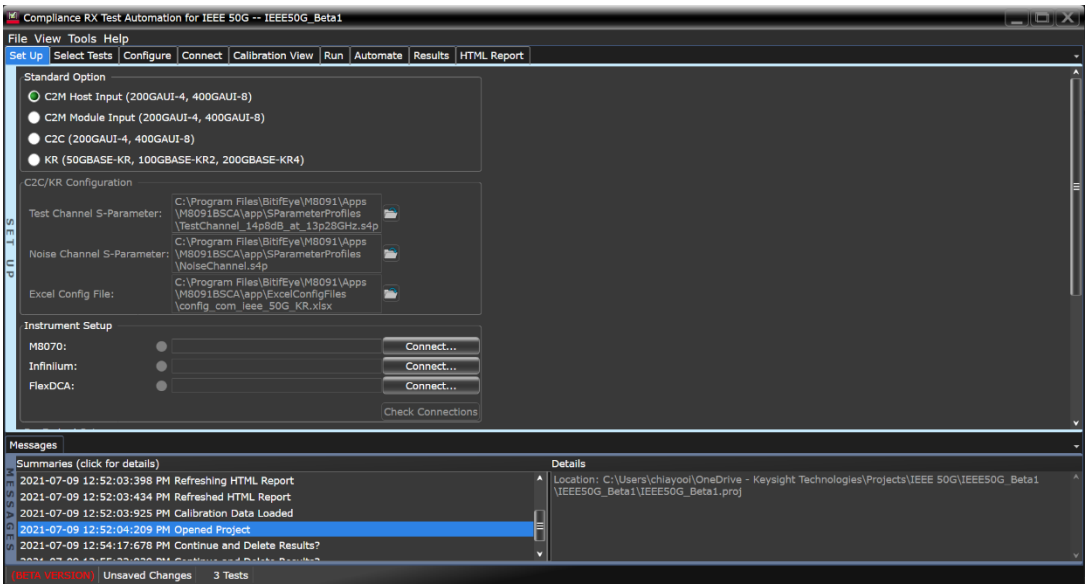


Figure 1. Graphic user interface of the M8091BSCA IEEE 802.3bs conformance receiver test application

The test application utilizes the same framework for the graphical user interface like most of Keysight transmitter test applications reducing training time by providing a common look and feel. When a user is required to perform setup changes, the user is guided by diagrams as well as text to minimize errors.

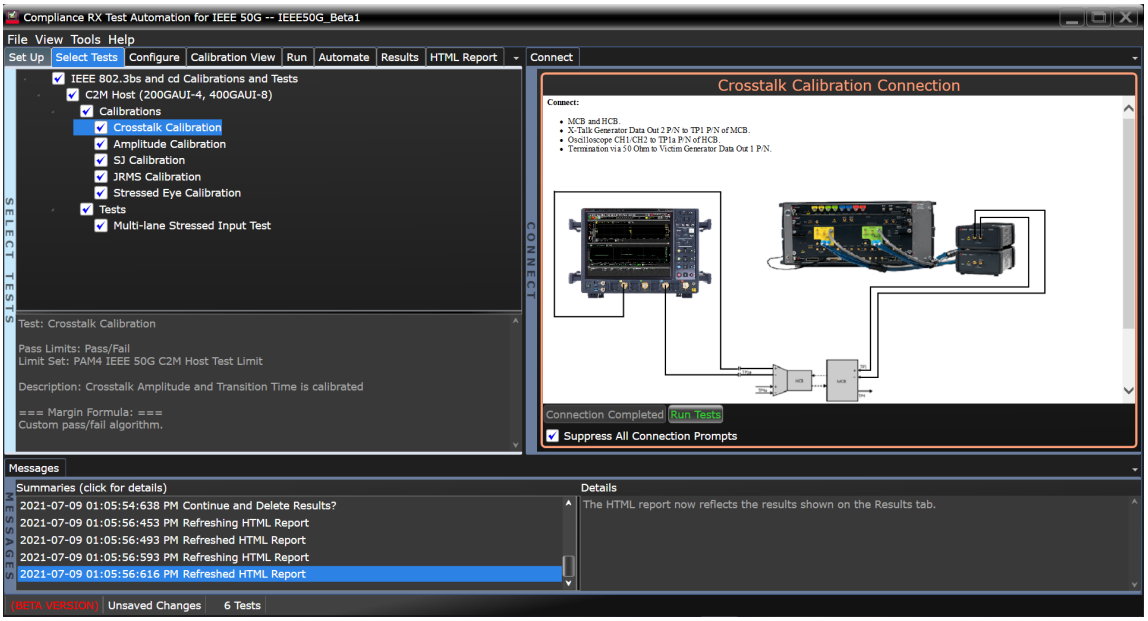


Figure 2. Connection diagram of the IEEE 802.3bs crosstalk calibration for C2M host input

The respective clauses and annexes of the IEEE 802.3 specification which were added during the IEEE 802.3 bs project for 200GbE and 400GbE define the stress signal through a mated Host Compliance Board (HCB) and Module Compliance Board (MCB) connection. Both the receiver side as well as the transmitter side do have equalization capabilities. The definition of the stress signal assumes an optimized link. Therefore, the transmitter of the receiver test equipment as well as the receiver of the signal measurement device must be optimized for the given stress channel. This must be done iteratively for each test setup. The standard requires the Transmitter Equalization (TxEQ) to be kept as small as possible to increase the stress on the Device Under Test's Receiver (DUT RX). This process is very time consuming. The M8091BSCA receiver test application performs this task automatically

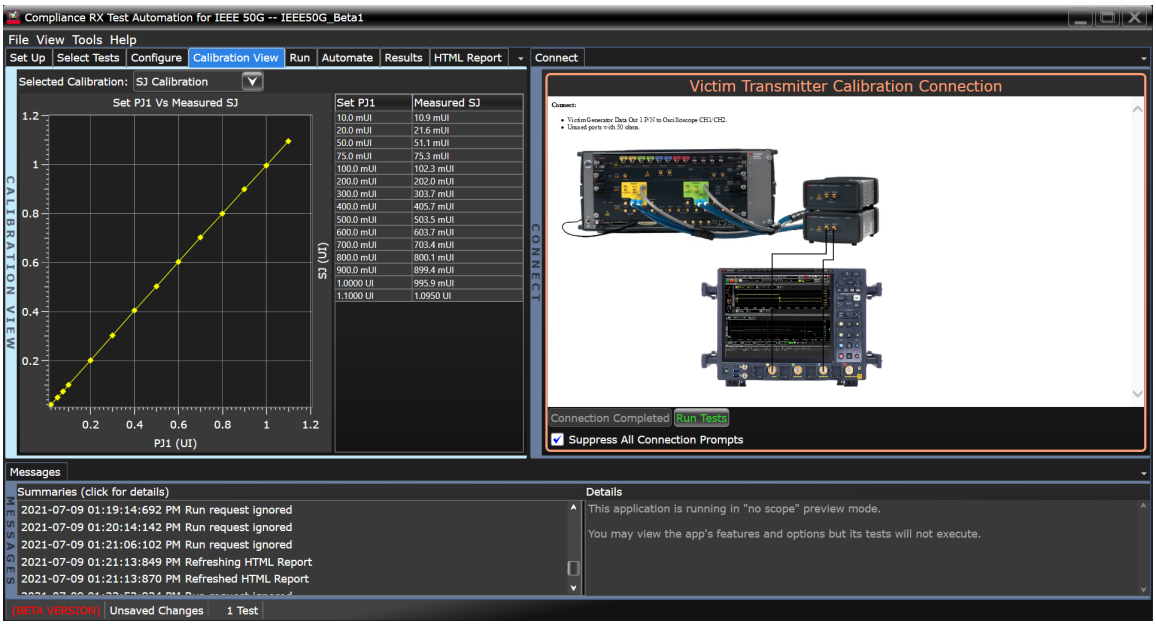


Figure 3. Results of the selected sinusoidal jitter calibration

Results of the individual calibration steps and tests are presented in tabular form as well as graphical form where appropriate. Calibrations and test results can be stored in projects and recalled at a later point in time. The application can also generate an HTML based test report.

Calibrations and Tests Covered by M8091BSCA Conformance Receiver Test Application

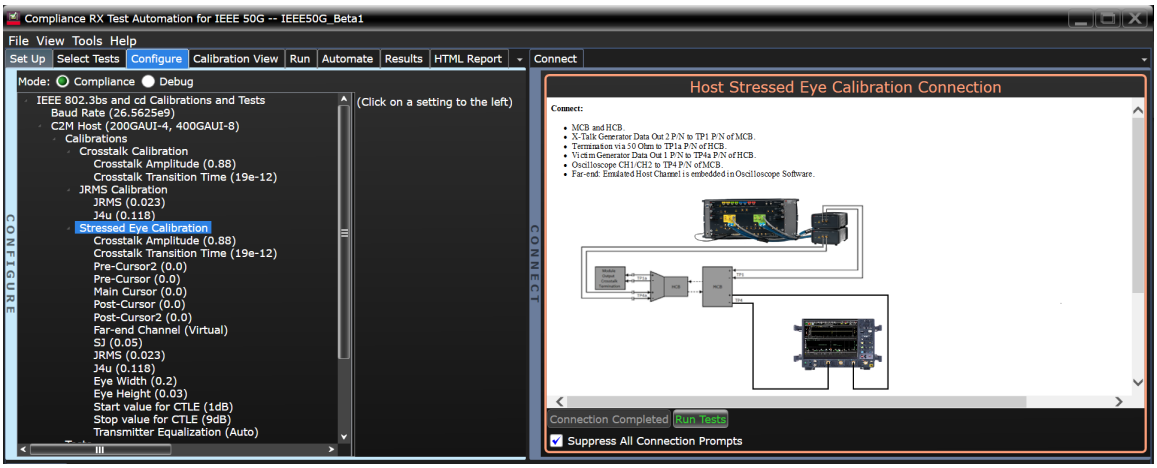


Figure 4. Parameters can be configured in either compliance or debug mode

All calibration steps are automated. The test application prompts the user when user interaction is required for connecting the test setup. Detailed connection diagrams and instructions are provided by the test application when each calibration or test is selected.

- 200GAUI-4 & 400GAUI-8 Chip to Module (C2M)
  - Calibrations are implemented according to IEEE 802.3bs Annex 120E
  - Victim lane amplitude
  - Victim lane JRMS
  - Victim lane SJ
  - Crosstalk amplitude and transition time [2]
  - Stressed eye
- Test is implemented according to IEEE 802.3bs Annex 120E
  - Stressed input
- 200GAUI-4 & 400GAUI-8 Chip to Chip (C2C)
  - Calibrations are implemented according to IEEE 802.3bs Annex 120D:
    - Amplitude
    - SJ
    - RJ
    - Broadband noise
    - Receiver interference tolerance
    - Receiver jitter tolerance
  - Tests are implemented according to IEEE 802.3bs Annex 120D:
    - Receiver interference tolerance
    - Receiver jitter tolerance
- 50GBASE, 100GBASE & 200GBASE Backplane (KR) [1]
  - Calibrations are implemented according to IEEE 802.3cd Clause 137.9.3:
    - Amplitude
    - SJ
    - RJ
    - Broadband noise
    - Receiver interference
    - Receiver jitter tolerance
- 50GBASE-CR, 100GBASE-CR2 & 200GBASE-CR4 Copper Cable (CR)
  - Calibrations are implemented according to IEEE 802.3cd Clause 136.9.4:
    - Amplitude
    - SJ
    - RJ
    - BUJ
    - SNDR
    - Receiver interference tolerance

- Receiver jitter tolerance
- Receiver input amplitude tolerance

○ Tests are implemented according to IEEE 802.3cd Clause 137.9.3

- Receiver Interference Tolerance
- Receiver Jitter Tolerance

Note:
1. Transmitter Equalization (TxEq) Auto Negotiation is not supported. The Transmitter Equalization must be adjusted manually.
2. The standard recommends carrying out the stress signal calibration using an aggressor lane with 19ps 20-80% transition time at 880 mV or 12ps slew time at ±270 mV for host and module test respectively. Similarly to the OIF-CEI 56G-VSR standard, the 12ps target cannot be achieved in realistic implementations. Keysight recommends using 15ps.

Configuration Guide

Following table below shows the required equipment for each standard option under IEEE 200GAUI-4 & 400GAUI-8 C2M, C2C, Backplane KR and Copper Cable CR receiver test setup. Required Instrument configuration and required software options are listed in the following section.

Equipment Type	C2M	C2C, KR, CR
Victim pattern generator	M8045A	
Crosstalk generator	M8045A 2nd channel or 3rd party crosstalk generator	N/A
Interference source	N/A	M8054A or M8195A or M8196A
Victim error detector	M8046A / DCI (DUT control interface)	
Clock recovery	M8046A - 0A4 (internal CDR) or N107xA / N1076B / N1077A / N1078A	
Oscilloscope	N1000A + N1060A or	
	N1092C/E or N1094A/B + N1076B/ N1077A/ N1078A or	
	UXR-Series oscilloscopes with 50 GHz bandwidth & above	

Minimum Required Instrument Configuration

M8040A 64 GBaud High-Performance BERT

M8040A-BU2	Bundle consisting of one M9505A 5-slot AXIe Chassis plus control module with USB option
M8045A	Pattern generator and clock module 32/64 Gbaud, 3 slot AXIe
• M8045A-G32	Pattern generator one Channel NRZ, Data Rate up to 32 GBaud (requires remote head, e.g. M8057A)
• M8045A-0G2	Second channel, hardware and license (requires remote head, e.g. M8057B) – recommended but not mandatory
• M8045A-0G3	Advanced jitter sources for receiver characterization, module-wide license
• M8045A-0G4	De-emphasis, module-wide license
• M8045A-0P3	PAM-4 Encoding up to 32 GBaud, module-wide license
• M8057B-FG	Remote head for M8045A pattern generator, 1 channel, two remote heads are needed
M8046A	Analyzer module, 32/64 Gbaud, 1-slot AXIe
• M8046A-A32	Analyzer, one channel, data rate up to 32 GBaud, NRZ
• M8046A-0A4	Clock recovery for 32 Gbaud, license
• M8046A-0P3	PAM-4 Decoding up to 32 GBaud
M8070B	System software for M8000 Series of BER test solutions
M8070ADVB-1xx	Advanced measurement package for M8000 Series of BERT test solutions (node-locked, transportable, floating or USB license

Choose on N107xx Clock Recovery if M8046A-0A4 Option is not Selected

N1076A/ N1077A	Electrical/optical clock recovery
• N107xA-232	Supported input rates: 50 MBd to 32 GBd
• N1076A-CR1	Clock recovery phase matching kit for N1076A electrical
• N1076A-2P2	Microwave pick-off tee 2.4 mm connectors, matched pair
• 11900B	2.4 mm female to 2.4 mm female adapter
• 83059A	Coaxial Adapter, 3.5 mm Male-Male
• N1027A-2P8	Microwave pick-off tee 1.85mm connectors, matched pair
• M8046A-802	Matched cable pair 2.4 mm (m) to 2.4 mm (m), two matched cable pairs are required
N1076B/ N1078A	Electrical/optical clock recovery
• N107xx-232	Supported input rates: 125 MBd to 32 GBd
• N1076B-CR1	Clock recovery phase matching kit for N1076B electrical
• N1027A-2P8	Microwave pick-off tee 1.85 mm connectors, matched pair
• 11900B	2.4 mm female to 2.4 mm female adapter
• 83059A	Coaxial adapter, 3.5 mm male-male
• M8046A-802	Matched cable pair 2.4 mm (m) to 2.4 mm (m), two matched cable pairs are required

Select an Interference Source for C2C, KR Application

• M8054A	Interference source 32 GHz (insert M8054A in slot 5, M3)
• M8195A-001	Arbitrary waveform generator, 1 channel, 65 GSa/s
• M8196A-001	Arbitrary waveform generator, 1 channel, 92 GSa/s

Select DCA Configuration – Select N1000A + N1060A or DCA-M + N1076B/ 77A/ 78A Clock Recovery

N1000A	DCA-X wide-bandwidth oscilloscope mainframe
• N1000A-PLK	Pattern lock trigger hardware model
N1060A	Precision waveform analyzer
• N1060A-050	Two 50 GHz channels
• N1060A-EVA	Equalizer integrated variable
• N1060A-232	Supported input rates: 125 MBd to 32 GBd
• N1060A-PTB	Precision timebase, ultra-low random jitter
• N1060A-JSA	Jitter spectrum analysis and clock recovery emulation
OR	
N109X	DCA-M optical and electrical sampling oscilloscopes
• N1092C	DCA-M sampling oscilloscope (one optical and two electrical channels)
• N1092E	DCA-M sampling oscilloscope (two optical and two electrical channels)
• N1094A	DCA-M sampling oscilloscope (two electrical channels)
• N1094B	DCA-M sampling oscilloscope (four electrical channels)

FlexDCA N1000-Series System Software – Choose DCA Options or R&D Package

DCA Options	
N1010AT-200	Enhanced jitter analysis SW
N1010AT-201	Advanced waveform analysis
N1010AT-9FP	PAM-N analysis software
N1010AT-SIM	InfiniiSim-DCA (embedding/de-embedding of cables or fixtures)
R&D Package	
N1010100A	Research and Development Package for FlexDCA DCA-X mainframe minimum configuration

Select UXR Configuration if DCA Options are not Selected

UXR0502A	50 GHz, 2-CH, 1.85mm input Infiniium UXR-Series real-time oscilloscope
D9320ASIA	Advanced signal integrity software (EQ, InfiiniSimAdv, crosstalk)
D9320PAMA	Pulse amplitude modulation PAM-N analysis software
D9320JITA	Jitter, vertical and phase noise analysis software for 90000, V-, Z- and UXR-series oscilloscopes

Accessories (Recommended)

M8045A-801	Short Cable, 1.85 mm (m) to 1.85 mm (m) (2 for each M8057B recommended)
M8045A-802	Matched directional coupler pair, 50 GHz, 13 dB, 2.4 mm
M8046A-801	Cable, 2.92 mm (m) to 2.92 mm (m), length 0.5 m
M8195A-810	Cable, 2.92 mm (m) to 2.92 mm (m), length 0.85 m (for combing SI and RI) (2 required, 3 if DCA-X)
M8195A-820	Coaxial termination 50 Ω DC to 26.5 GHz, 3.5 mm (male) (2 required)
SP0606A	Wilder QSFP-DD 112G/800G MCB 1.85mm Receptacle Test Adapter
SP0607A	Wilder QSFP-DD 112G/800G HCB Plug 1.85mm Test Adapter
M8049A-002	ISI channel board, nine traces from 0.8 to 8.0 inches
M8049A-003	ISI channel board, seven traces from 9.1 to 22.3 inches
Y1901B	Adapter, 1.0 mm ruggedized (f) to 1.85 mm (f), DC to 67 GHz
N2125A	Infiniium UXR real-time oscilloscope calibration module, 1 mm
11636C	Power Divider, DC To 50 GHz, 2.4 mm

Software Configuration

M8091BSCA	RX Conformance test application for IEEE 802.3bs

Minimum PC Configuration

The PC running the application should meet following requirements:

PC Hardware Requirements	
• Memory	8 GB RAM minimum
• Monitor resolution	WXGA+ (1140 x 900) minimum

PC Software Requirements

- Keysight IO Library suite rev 18.1
- Keysight License Manager 5 and Keysight License Manager 6
- M8070B system software for M8000 series
  - Ver. 10.5.180.6
  - M8070ADVB advanced measurement package for M8000 Series
    - Ver. 1.6.180.2
  - M8195A Firmware and SFP rev. 4.2.2.0
  - M8196A Firmware and SFP rev. 2.1.13.0
  - Microsoft Office 2010 or higher
- MATLAB compiler runtime R2017a (9.2)
- Keysight DCA-X oscilloscope FW A.07.50.258
- Keysight UXR oscilloscope FW rev. 11.52.00001

Remote Programming

The M8091BSCA IEEE 802.3bs Conformance Test Application is part of Keysight's Digital Test Apps and can be programmed via ARSL, any .NET language or through the LabVIEW graphical programming interface. For more information see www.keysight.com/find/rpi

Related Products

The M809256CA Electrical Receiver Conformance Test Application for OIF-CEI 4.0 designed to assist and simplify the stress signal calibration used for testing the inputs of OIF-CEI 56G-VSR/-MR/-LR PAM4.

The N1091BSCB Electrical TX Test SW for IEEE 802.3bs/cd (50/100/200/400 Gb/s for the sampling oscilloscopes offer automated transmitter testing for IEEE PAM4-based electrical outputs.

The N4917BSCB Optical Receiver Stress Test Application addresses test needs for optical input test of transceiver modules for 400GBASE-LR8/-FR8 as well as 200GBASE-LR4/-FR4/-DR4.

The M8091CKCA is industry's first electrical receiver test application for IEEE 802.3ck which assist and simplify the stress signal calibration used for testing the inputs of IEEE 100G serial interfaces.

The N1091CKCA Electrical TX Test Software for IEEE 802.3ck (100/200/400 Gb/s for the sampling oscilloscopes offer automated transmitted testing for IEEE PAM-4 based electrical outputs.

The D90103CKC Electrical TX Test Software for IEEE 802.3ck (100/200/400 Gb/s for the real-time oscilloscopes offer automated transmitter testing for IEEE PAM4-based electrical outputs.